LA-UR-22-21337

Approved for public release; distribution is unlimited.

Title:	LANSCE Overview for NA-113 WANDA 2022
Author(s):	Barraza, Juan Mosby, Shea Morgan
Intended for:	WANDA 2022 input plenary session material for NA-113
Issued:	2022-02-16

Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Los Alamos
NATIONAL LABORATORY

LANSCE Overview for NA-113 WANDA 2022

Abstract: Attached are presentation materials providing summary levels of LANSCE accelerator technical capabilities and experimental beam line applications with their associated user communities. These presentations are being provided as input material for the plenary session to be delivered by NA-113 at the WANDA 2022 meeting.

LANSCE's unique flexibility serves a variety of missions

Proton Radiography (pRad Facility)
- Dynamic radiography for defense programs and counterproliferation

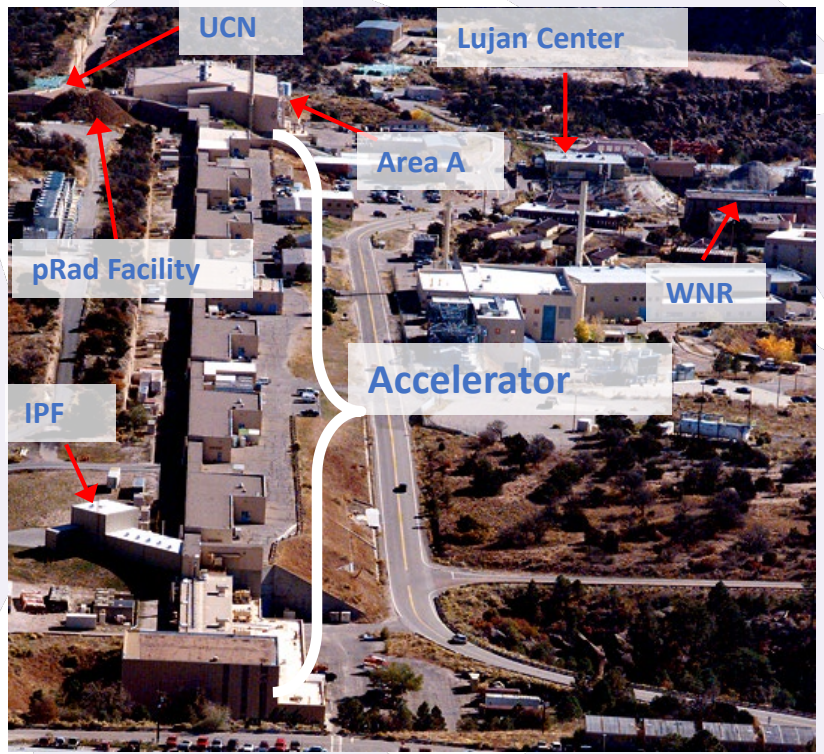
Lujan Neutron Scattering Center (Lujan Center)
- Neutron scattering and imaging for defense programs and nuclear energy
- Nuclear physics for defense programs

Weapons Neutron Research Facility (WNR)
- Nuclear physics for defense programs, counterproliferation, and criticality safety
- Electronics testing for industry and global security

Isotope Production Facility (IPF)
- Medical and other isotopes for the isotope program
- Short-lived isotopes for defense programs, non-/counterproliferation, and criticality safety

Ultra-Cold Neutron Facility (UCN)
- Unique probe for nuclear physics and NSF, possible future defense program uses

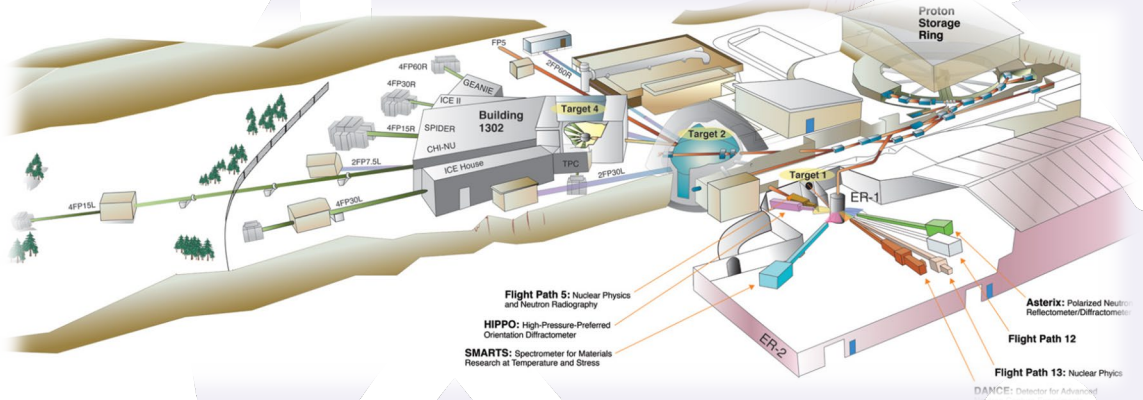
Area A
- *Future experimental possibilities*



100-800 MeV proton energies
six target stations (three neutron spallation targets)
sixteen beam lines

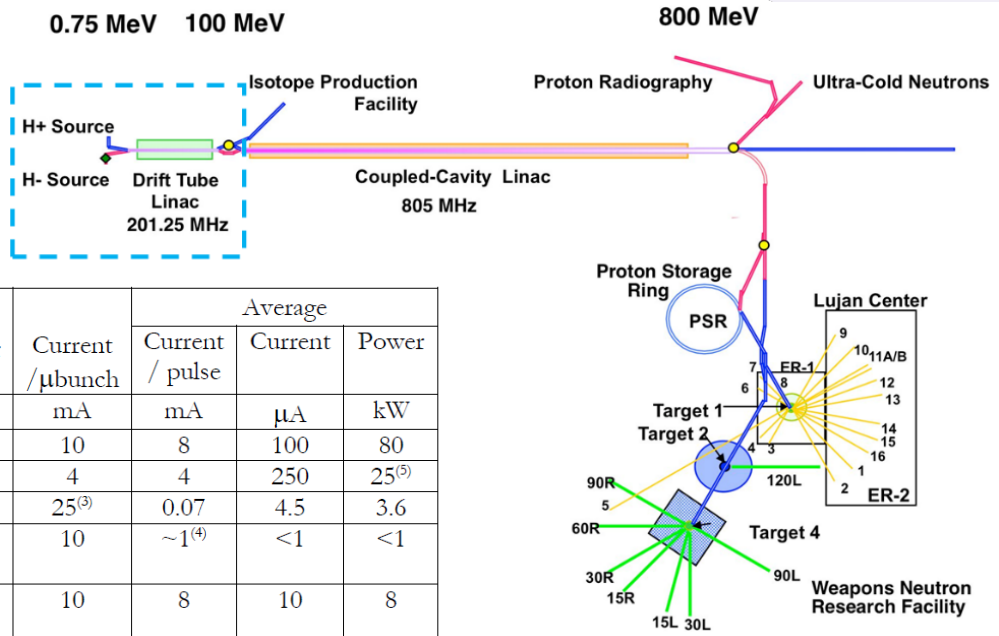
LANSCE's unique accelerator operations, safety basis, and security infrastructure support diverse mission spaces

- Proton Radiography
- High Explosive Drive
- Classified Experiments
- Dynamic Plutonium Capability
- Low-Energy Nuclear Physics
- Isotope Production
- Neutron Diffraction
- Static Plutonium
- Neutron Radiography
- Energy-Resolved Tomography
- Neutron Irradiation for Defense and Civilian Applications



LANSCE delivers diverse research beams supporting multiple missions

PSR: Proton Storage Ring
IPF: Isotope Production Faciltiy
WNR: Weapon Neutron Research
pRad: Proton Radiography
UCN: Ultra-Cold Neutrons



v1.1 – 2019-12-09 Facility	Species[1]	Pulses / sec	RF Macropulse length[2]	Chopper fraction	Current /μbunch	Average Current / pulse	Average Current	Average Power
			μs		mA	mA	μA	kW
Lujan/PSR	H^-	20	625	0.8	10	8	100	80
IPF	H^+	100	625	1	4	4	250	25[5]
WNR	H^-	100	625	$2.8 \cdot 10^{-3}$	25[3]	0.07	4.5	3.6
pRad	H^-	On demand	<625	-	10	~1[4]	<1	<1
UCN	H^-	10, at 0.2 Hz	625	0.8	10	8	10	8

[1] as delivered by the CCL to the Switchyard.
[2] maximum duration with beam current present; actual RF pulse duration is longer to allow for the DTL structure fill time.
[3] a subharmonic buncher is used to increase the bunch current above the source average current.
[4] IPF receives beam at 100 MeV; other facilities receive beam at 800 MeV.
[5] pRad receives 90-ns trains of 10-mA μbunches, spaced at ≥ 1 μs.

LANSCE material and nuclear data are critical for stockpile assessment and certification

The LANSCE accelerator complex is a **unique NNSA resource** that acquires an enormous range of **physics and engineering data** required by the Los Alamos, Livermore, and Sandia weapons programs

- Authorization basis to **perform classified experiments with special nuclear material** using protons and neutrons
- **Unique capability to measure a breadth of nuclear data** needed for initial conditions for boost, neutron reactivity, nuclear forensics, and criticality safety
- **Provides qualification and characterization** of new and aged materials, components, and high explosives **for Significant Finding Investigations (SFIs), Life Extension Programs (LEPs), Alterations**, and **Modifications**, as well as to qualify **new manufacturing methods**

LANSCE's experimental areas support all parts of NNSA's mission space

Mission/Area	Dynamic radiography (pRad)	Neutron scattering (Lujan)	Nuclear physics (Lujan/WNR)	Neutron radiography (Lujan/WNR)
Stockpile Sustainment	Significant findings; hydrodynamic experiment interpretation; *plutonium aging studies*	Plutonium aging studies; secondary and high explosive material properties	Underground nuclear test analysis; key nuclear data for neutron reactivity metrics	Component surveillance/ inspection
Future Deterrent	Explosive and subsystem characterization/ design (e.g., detonators); subcritical experiment interpretation; *safety/surety*	Advanced model development; scintillator development for hydrodynamic and subcritical experiments	2018 Level 1 pegpost; subcritical experiment interpretation	Advanced inspection technique development
Modern Materials and Manufacturing	**New explosive characterization**/formulation; *plutonium manufacturing*	Direct cast uranium; advanced manufacturing (e.g., plutonium alloys and secondary components)	Criticality assessments for safety and efficiency; effects quantification	Component inspection
Threat Mitigation (NA-20/80)	**Render safe design; foreign materials**	**Scintillator and sensor development for nonproliferation**	**Nuclear data for foreign threats and nonproliferation; effects quantification**	***Foreign components***

Italics show planned future capabilities
Bold shows global security applications

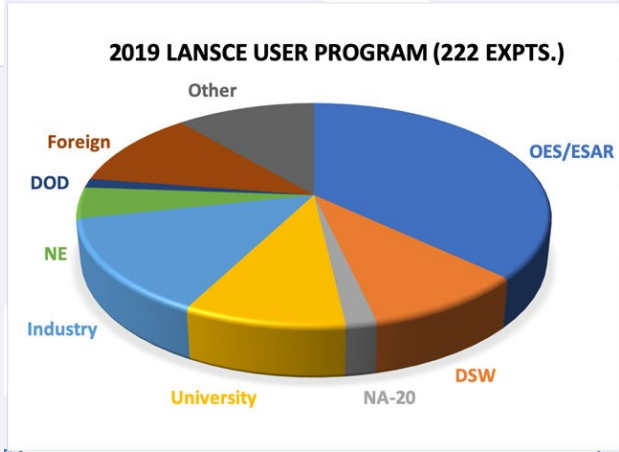
pRad, Lujan, and WNR constitute the NNSA LANSCE User Facility

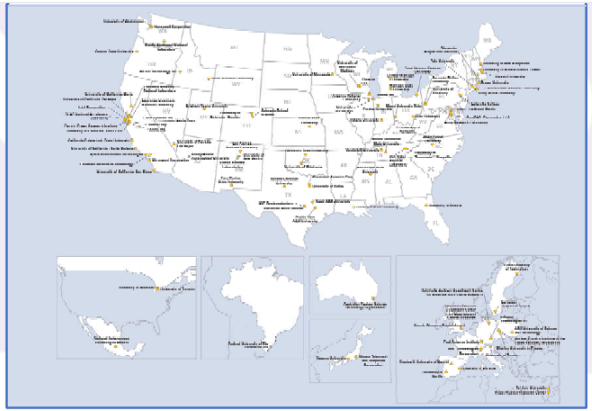
Proposal process:

- Proposals are solicited in January
- Each is reviewed for feasibility
- Feasible proposals go to review committees in February/March. Each proposal is evaluated for technical merit, relevance, and resource usage
- The committees send recommendations to the program in April. The program selects the final plan, with concurrence from line management and the LANSCE user facility director
- Experimental reviews before execution ensure safety, security, regulatory, and technical readiness
- During June-December run cycle, programs adjust schedules to account for changes in beam delivery, sample availability, programmatic relevance, etc.

As a rule, ~80-85% of the experiments/beam time support NNSA mission deliverables and ~15-20% are reserved for experimental research and development.

All experimental areas are ~2x oversubscribed





2019 run cycle: 591 users, 101 institutions, 16 countries